REMARKS

The official action of 17 September 2008 has been carefully considered and reconsideration of the application as amended is respectfully requested.

The indication that claims 29-42 are allowed and that claims 25 and 27-28 would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims has been noted with appreciation.

Claims 3-5 have now been canceled and replaced by new claims 43-45 and 50-51. The newly added recitations in these claims draw support from the specification as filed at, for example, page 16, first full paragraph; the paragraph bridging pages 17 and 18; the paragraph bridging pages 18 and 19; the first full paragraph on page 19; the paragraph bridging pages 29-30 (describing the mixed gas and the mixed gas having an ionization efficiency higher than that of the atmospheric gas); the paragraph bridging pages 57 and 58 in connection with Fig. 10; and Fig. 14 (showing the carbon nanotube fibers entangled with each other). Claims 20-23 have been canceled and replaced by new claims 46-49. The newly added recitations in claims 46-49 draw support from the specification as filed at, for example, page 16, first full paragraph; the paragraph bridging pages 17 and 18; and the paragraph bridging pages 18 and 19.

Claims 1 and 3-18 were rejected under 35 USC 102(b) as allegedly being anticipated by Tsuboi. Claim 2 was rejected under 35 USC 103(a) as allegedly

being unpatentable over Tsuboi. Applicants respectfully traverse these rejections.

The present invention is based at least in part on Applicants' discovery that, in an arc discharge process, it is possible to synthesize tape-like material formed of unrefined carbon nanotubes entangled with each other by restricting the path of arc generation by jetting an inert gas having ionization efficiency higher than that of an atmospheric gas or an inert-containing mixed gas from (an inside of) a (hollow) anode to a cathode comprising carbon material and that the tape-like material so formed comprises highly purified multilayer carbon nanotubes which are not required to be refined. The highly purified carbon nanotubes may be obtained without refinement because polycrystalline graphite and amorphous carbon, which are by-products in the production process of the carbon nanotubes (attached on front and rear surfaces of the tape-like material) are preferentially oxidized and burned when the tape-like material is peeled from the cathode in oxidizing atmosphere due to burning temperatures of the impurities being lower than that of the carbon nanotubes.

Claims 43-45 and 50 contain product-by-process limitations which at least in part define the claimed tape-like material by the process by which it is produced. As can be seen from the scanning electron micrographs shown in Fig. 12 of the drawings and the schematic illustration in Fig. 14, the carbon nanotube tape produced by the claimed process has a distinctive structure as compared with other carbon nanotubes. Compare scanning electron micrograph of Fig. 12

with scanning electron micrograph of Fig. 20. As provided in MPEP 2113, the structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product.

The cited reference, Tsuboi, could not be expected to impart the distinctive structural characteristics described and claimed herein to the final product formed in Tsuboi. Tsuboi discloses to refine crude carbon nanotubes (unrefined carbon nanotubes containing a metal catalyst or the like) by crushing the crude carbon nanotubes with a crusher, putting solvent (such as acetone) and the crude carbon nanotubes into a beaker to apply ultrasonic wave, then resting the same for about 10 minutes, and after that, taking out supernatant solution (upper portion solution) of a middle to upper portion with high purity of carbon nanotubes from the fluid dispersion, (see paragraph [0012]).

Also, it is disclosed to accumulate and deposit carbon nanotubes 301 on an entire upper surface of a substrate 101 by setting the insulating substrate 101 on which a cathode conductor 102 is deposited on an inner bottom of a container 201, pouring upper portion solution 202 of suspending solution obtained as in the above-description into the container 201, and drying the same until acetone is naturally evaporated, (see paragraph [0013]).

A tape-like material (301) joined to the substrate (101) and a peeled tape-

like material (301) attached to the substrate (101), which are pointed out by the examiner, are disclosed in the paragraphs [0014] and [0015] that "after attaching a (general) adhesive tape to an upper surface of the carbon nanotube 301 deposited on the entire upper surface of the substrate 101 as in the above-description, by peeling the adhesive tape 403, the carbon nanotubes 301 of an exposed portion of the substrate 101 (the portion on which the cathode conductor 102 is not deposited on the substrate 101) are peeled from the substrate 101, and the carbon nanotubes on the cathode conductor 102 remain in a state deposited on the cathode conductor 102."

In other words, the cited reference merely discloses to form an emitter substrate 402 having carbon nanotubes with a pattern identical to that of the cathode conductor 102, by preparing the fluid dispersion of the powder carbon nanotubes and performing the refining operation, and after that, depositing the same on the substrate to dry, and peeling the carbon nanotubes deposited on a portion other than the cathode conductor with the adhesive tape. This does not disclose or suggest the claimed tape-like material formed of carbon nanotubes entangled with each other, wherein highly-pure carbon nanotubes are obtained without refinement because polycrystalline graphite and amorphous carbon, which are by-products in production process of the carbon nanotubes, attached on front and rear surfaces of the tape-like material are preferentially oxidized and burned when the tape-like material is peeled from the cathode in the air due to burning temperatures thereof lower than that of the carbon nanotubes.

With particular respect to claims 14-18, the reference *a fortiori* does not show or suggest the claimed field emission electrode or the claimed process for producing the same using the claimed tape-like material formed of unrefined highly-pure carbon nanotube fibers entangled with each other. Thus, in the claimed field emission electrode,the tape-like material adheres to the substrates or the substrate and the material more deformable than the substrate by pinching the same between the substrates or between the substrate and the material more deformable than the substrate to apply a pressure and separating them. The tape-like material is torn in a thickness direction and the tape-like material adheres thereto in a manner exposing a torn surface, when producing the field emission electrode by using the tape-like material formed of carbon nanotubes entangled with each other, thereby the electrode having excellent field emission performance is obtained.

On the other hand, the material more deformable than the substrate, that is to say, the adhesive tape taught by Tsuboi, is "selected such that the carbon nanotubes 301 deposited on the cathode conductor 102 remain in a state deposited on the cathode conductor 102 when being peeled, and the carbon nanotubes 301 deposited on the exposed portion are deposited on the adhesive tape 403 to be peeled from the substrate 101" (paragraph [0014]), and it is impossible to tear the carbon nanotubes 301 in a thickness direction with such adhesive tape. The cited reference does not disclose or suggest the field emission electrode in which the carbon nanotubes 301 are torn in a thickness direction and adhere in a manner exposing the torn surface as in the claimed

invention.

In view of the above, Applicants respectfully submit that the cited reference does not show or suggest the claimed tape-like material or the claimed field emission electrode produced therefrom. Accordingly, Applicants respectfully request withdrawal of the rejections to these claims.

Claims 20-24 and 26 were rejected under 35 USC 102(b) as allegedly being anticipated by Huang et al. Applicants respectfully traverse this rejection.

Huang merely discloses a process for producing carbon nanotubes by arc discharge between a first electrode arranged in a chamber and connected to a positive potential and a second electrode comprising a carbon material also arranged in the chamber and connected to a negative potential, wherein the first electrode has a through-hole on a central portion thereof to introduce an inert gas, a catalyst, and gas containing organic vapor. Huang does not disclose or suggest the claimed process step to restrict a path of arc generation by generating an arc while an inert gas having ionization efficiency higher than that of an atmosphere gas or an inert gas-containing mixed gas is jetted from (an inside of) a (hollow) anode to a cathode comprising a carbon material. That is to say, Huang does not show or suggest to restrict the path of arc generation by jetting an inert gas having ionization efficiency higher than that of the atmosphere gas or an inert gas-containing mixed gas along only a part of the path from the anode to the cathode as in the claimed method.

In the cited reference, although helium or a gas containing hydrogen is selected as the atmospheric gas in a chamber so as to make fullerene, this is not the same as jetting an inert gas having an ionization efficiency higher than that of the atmosphere gas or the inert gas-containing mixed gas to the cathode as in the claimed invention. Without this disclosure, it is not possible to preferentially and efficiently synthesize carbon nanotubes by restricting the path of arc generation and fixing the arc spot, as in the claimed invention.

In short, in the cited references, it is shown or suggested to produce a tape-like material of unrefined carbon nanotubes formed of highly-pure carbon nanotube fibers entangled with each other into a tape-like shape, by restricting the path of arc generation by jetting the inert gas having ionization efficiency higher than that of the atmosphere gas or the inert-containing mixed gas along only a part of the path from the anode to the cathode and by relatively movement of the anode and the cathode. Since the cited references do not disclose or suggest to do so, they cannot be said to anticipate or to render obvious the invention defined by any of the claims as amended.

In view of the above, Applicants respectfully submit that all objections and rejections of record have been overcome and that the application is now in allowable form. An early notice of allowance is earnestly solicited and is believed to be fully warranted.

Respectfully submitted,

CLIFFORD J. MASS
LADAS & PARRY LLP
26 WEST 61ST STREET
NEW YORK, NEW YORK 10023
REG. NO.30,086 (212)708-1890